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FACT SHEET

An Example of Demonstrating Compliance with Ambient Impact Requirement. (COMAR 26.11.15.06)

Let's say the Krusty Brand Cereal Manufacturing Division is building a new facility in Accident, Maryland (Garrett County). The new facility will be running three shifts continuously to make Chocolate Sugar Bombs Cereal. The facility will also produce the prizes included in each box, plastic statuettes.

As a part of the requirements of the toxics regulations, the plant owners must install T-BACT because the manufacturing line is a new installation (COMAR 26.11.15.05). T-BACT for this facility is determined to be venturi scrubbers, packed bed scrubbers, a regenerative thermal oxidizer, a large diameter cyclone, and a fabric filter.

To satisfy the requirements of COMAR 26.11.15.04, the company reports that the following toxic air pollutants will be emitted after control.

Pollutant	Emissions (#/hr)	Emissions (tpy)
Acetaldehyde (75-07-0)	0.25	0.15
Antimony (7440-36-0)	0.25	0.15
Benzene (71-43-2)	0.15	0.24
Formaldehyde (50-00-0)	1.5	1.0
Isopropyl Alcohol (67-63-0)	1.0	0.6
Methylcyclohexane (108-87-2)	0.25	0.15
Xylene (1330-20-7)	60.0	36.0

The screening levels for these pollutants are listed below. The "I" or "II" before the pollutant name signifies the class of the pollutant.

Pollutant	Screening Level (ug/m^3)		
	1-hour	8-hour	Annual
I: Acetaldehyde (75-07-0)	450	---	4.55
II: Antimony (7440-36-0)	---	5	---
I: Benzene (71-43-2)	80	16	1.21
I: Formaldehyde (50-00-0)	3.7	---	0.769

II: Isopropyl Alcohol (67-63-0)	12300	9830	---
II: Methylcyclohexane (108-87-2)	---	16100	---
II: Xylene (1330-20-7)	6510	4340	---

At this point, Krusty Brand Cereal has satisfied two of the three requirements of the TAP regulations, COMAR 26.11.15.04 (Quantify TAPs) & 26.11.15.05 (T-BACT). The final requirement (COMAR 26.11.15.06) is that the emissions of TAP must not adversely impact public health beyond the property line.

To satisfy this requirement, each pollutant must be individually evaluated through a series of increasingly non-conservative (and increasingly rigorous) tests. As soon as a pollutant can demonstrate that public health will not be adversely impacted, no further evaluation for that pollutant is needed.

Each pollutant is first checked to see if it may qualify for a small emitter exemption under COMAR 26.11.15.03(B)(3)(a) or (b). If it does not qualify, the pollutant and its impact is evaluated using the charts in COMAR 26.11.16.02. If it cannot comply using the charts, the pollutant's impact is evaluated with a simple screening model, either ARMA's TM 86-02 or EPA's SCREEN. Past this point, the emissions of the TAP should be modeled using a refined dispersion model, such as ISC. Let's see how Krusty Brand Cereal does!

1. Small Emitter Exemptions.

- For a class I pollutant to qualify for the small emitter exemption, the premise-wide emissions of a pollutant must be 0.5 #/hr (or less) and 350 pounds per year (or less). Additionally, its short-term screening levels (1-hour or 8-hour) must be greater than 200 ug/m^3 and the annual screening level must be greater than 1 ug/m^3.

  Krusty Brand Cereal will emit three class I pollutants. The emission rates of acetaldehyde and benzene are less than 0.5 #/hr. However, benzene has an annual emission rate greater than 350 pounds per year, so it does not qualify. (In addition, benzene's short-term screening levels are less than 200 ug/m^3.) Acetaldehyde is still in the running. Checking the screening levels, the short-term is above 200 ug/m^3 and the annual is greater than 1 ug/m^3. Therefore, acetaldehyde meets the criteria for an exemption and we don't have to evaluate it any more.

- For class II pollutants to qualify for the small emitter exemption, the premise-wide emissions of a pollutant must be 0.5 #/hr (or less) and its short-term screening levels must be greater than 200 ug/m^3.

  Krusty Brand Cereal will emit four class II pollutants. Antimony and methylcyclohexane both meet the emission rate criteria. However, antimony with its 8-hour screening level of 5 ug/m^3 does not qualify. Methylcyclohexane does meet the criteria and no further review will be needed for it.

2. Charts of Allowable Emissions in COMAR 26.11.16.02.

The charts are the result of a very simple, conservative modeling. With the chart, you can determine the maximum emission rate of a TAP based on the screening level of the TAP. For example, if we were examining a pollutant with a 1-hour screening level of 100 ug/m^3, the allowable emission rate from a stack source (10 meters high or greater & no downwash) would be 1.6 pounds per hour. Krusty Brand Cereal, a source with a 25-meter stack with no downwash, still has some TAPs to evaluate. Let's see if they can pass with the charts.

- Antimony has an 8-hour screening level of 5 ug/m^3. Using the chart, we see that the allowable emissions for a stack source and a pollutant with a screening level between 1 and 9.9 ug/m3 is 0.01 #/hr. Krusty Brand Cereal emits 0.25 #/hr. Compliance is not shown.

- Benzene has an 8-hour screening level of 16 ug/m^3, a 1-hour screening level of 80 ug/m^3, and an annual screening level of 1.21 ug/m^3. The allowable emissions, as read from the charts, would be 1664.4 #/yr (based on the annual screening level), 0.98 #/hr (based on the 1-hour screening level), and 0.16 #/hr (based on the 8-hour screening level). Krusty Brand Cereal emits only 480 #/yr and 0.15 #/hr of benzene. Krusty Brand Cereal has shown compliance with the ambient impact requirement for benzene!

- Formaldehyde is emitted from Krusty Brand Cereal at a rate of 1.5 #/hr with an annual emission rate of 2000 pounds per year. Based on the screening levels of formaldehyde, Krusty would only be allowed 0.01 #/hr and 166.44 pounds per year. Clearly, compliance with the regulation has not been shown.

- Isopropyl alcohol and xylene emissions are allowed from a stack source if the facility-wide emissions for each pollutant are less than 4.07 #/hr. Krusty Brand Cereal is reporting isopropyl alcohol emissions of only 1 #/hr. Therefore, Krusty has shown compliance with the TAP regulations for isopropyl alcohol. Xylene emissions are expected to be 60.0 #/hr. We need to go to the next level with xylene.

Score Card to this point (for the viewers at home):

Pollutant	Compliance Shown (Method)
Acetaldehyde (75-07-0)	Yes (Small Emitter)
Antimony (7440-36-0)	No
Benzene (71-43-2)	Yes (Charts in 16.02)
Formaldehyde (50-00-0)	No
Isopropyl Alcohol (67-63-0)	Yes (Charts in 16.02)
Methylcyclohexane (108-87-2)	Yes (Small Emitter)
Xylene (1330-20-7)	No

3. Charts in COMAR 26.11.16.02 Revisited.

As said earlier, the charts are based on a conservative model. As an alternative to pigeon-holing pollutants to the ranges provided, we can evaluate pollutants using the equations that govern the charts. Using this method, an allowable emission for a facility can be determined for each individual pollutant.

The equations that govern the chart are given below:

	Stack Sources, no downwash	Non-stack or downwash sources
Annual	SL = 0.0006 AER	SL = 0.00274 AER
1-hour / 8-hour	SL = 62.5 AER	SL = 279 AER

where: SL is the screening level in ug/m^3, and;
AER is the premises-wide allowable emission rate in #/yr or #/hr.

Applying this to the Krusty Brand Cereal example, we still have 3 pollutants that have not shown compliance with the TAP regulation, antimony, formaldehyde, and xylene.

- The 8-hour screening level for antimony is 5 ug/m^3. Using the equation for a stack source, 8-hour screening level, the allowable premises emission rate is 0.08, (5 / 62.5), pounds per hour. The expected emissions of antimony are 0.25 pounds per hour. Krusty has not reached the compliance plateau.

- Formaldehyde has both a 1-hour and an annual screening level. Krusty must show compliance with both. The allowable emissions determined from the 1-hour equation is 0.0592, (3.7 / 62.5), pounds per hour. The allowable emission rate as determined from the "Annual, Stack source" equation is 1281 pounds per year. Krusty Brand Cereal calculated their emissions to be 1.5 pounds per hour and 2000 pounds per year. Once again, TAP compliance

is not shown.

- Xylene has both a 1-hour and an 8-hour screening level. Krusty Brand Cereal will be emitting xylene at 60 pounds per hour. The allowable emission rate based on the 1-hour screening level is 104 pounds per hour. The allowable emission rate based on the 8-hour screening level is 69.4 pounds per hour. Since the actual emissions are less than the allowable, Krusty Brand Cereal has shown compliance with TAP regulations for xylene.

4. TM 86-02.

If companies have not shown compliance for any pollutants at this stage, they may use a technical memorandum that ARMA has developed to show compliance. ARMA Technical Memorandum 86-02 is a method companies can use to predict ambient impacts from TAP emissions.

While this option is still available for use, it is suggested that this step be skipped to proceed to the simple computer screening model step. The use of a computer screening model (such as SCREEN or TSCREEN) takes a few minutes (usually less than a minute) to set-up and to get results. TM 86-02 is a long series of hand-calculations to predict impacts and may be more susceptible to user error.

Krusty Brand Cereal opted not to use TM 86-02.

5. Screening Models.

The most common screening models (SCREEN or TSCREEN) combines site-specific information (such as stack height, gas temperature, and other physical properties) and generic weather information to predict ground level concentrations of pollutants. The predicted concentrations of the model are compared to the screening level of the pollutant. If the predicted concentration is less than the screening level, then compliance is shown.

Krusty still has two pollutants that have not shown compliance with the TAP regulations. Krusty Brand Cereal performed two separate models, one for each pollutant.

The 8-hour impact for antimony was calculated by the model as 0.625 ug/m^3. This, as you may recall, is less than the 8-hour screening level of 5 ug/m^3. Krusty is now in compliance for antimony.

However, Krusty still has a problem with formaldehyde. The SCREEN model predicted a 1-hour impact of 5.36 ug/m^3 which is higher than the 3.7 ug/m^3 screening level. SCREEN predicted formaldehyde's annual impact as 0.43 ug/m^3, which is lower than the annual screening level. Krusty Brand Cereal will need to go to the next level to demonstrate compliance for formaldehyde.

6. Refined Modeling.

Refined modeling is similar to a screen model run, however, real weather data is used. Ground level concentrations of pollutants can be calculated in three dimensions as opposed to only two. Refined modeling will give the least conservative ground concentrations, that is, will give a result that is closer to the actual concentrations, if they were to be measured.

Refined modeling involves a complex set-up routine inputting the source's physical parameters, the 5 most recently available years of weather data, and the identification of points in space where the model will calculate concentrations. Once the model is ready to run, the actual run time may last from a few minutes to a few hours depending on the complexity of the source. Sources that intend to perform refined modeling should contact the Department for guidance.

Krusty Brand Cereal, still needing to show compliance for formaldehyde, has selected to use the Industrial Source Complex (ISC) Model. The results of the model calculate the maximum ground level concentration (1-hour average) as 2.8 ug/m^3. The maximum annual concentration is calculated as 0.568 ug/m^3. The predicted concentrations are less than the screening levels for formaldehyde and, finally, Krusty Brand Cereal has shown full compliance with the TAP regulations.

If, after using a refined model, Krusty had not shown compliance, the company would need to reduce emissions of TAPs by decreased production, adding control equipment, or substituting input materials.